

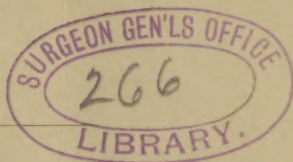
McClellan (Ely)

# CHOLERA HYGIENE.

By ELY McCLELLAN, M. D.

ASSISTANT SURGEON U. S. A.

[REPRINTED FROM THE AMERICAN PRACTITIONER, 1874.]



LOUISVILLE:

PRINTED BY JOHN P. MORTON AND COMPANY.

1874.



# CHOLERA HYGIENE.

✓  
By ELY McCLELLAN, M. D.

ASSISTANT SURGEON U. S. A.

[REPRINTED FROM THE AMERICAN PRACTITIONER FOR FEBRUARY, 1874.]

Surgeon Genl's Office  
LIBRARY  
54371  
Washington, D. C.  
LOUISVILLE:

PRINTED BY JOHN P. MORTON AND COMPANY.

1874





## CHOLERA HYGIENE.

---

During the months of August and September, 1873, it was the fortune of the writer of these pages to witness the epidemic of cholera in the counties of Garrard and Marion of the state of Kentucky, and at a later date to investigate the manifestations of the disease as they appeared in some twenty-six counties of the state.

A careful study of this epidemic, and a rigid comparison of the features presented by it with authentic histories of the disease, as well as those manifestations which the writer had witnessed in widely-separated regions of the United States, developed no new facts in the etiology of cholera.

In the vast majority of the locations infected with cholera in the state of Kentucky during the past year *the direct importation of the disease* has been most satisfactorily proven. The facts relating to the individuals who acted as the porters of the disease have been obtained, and step by step, from its inception to its close, the epidemic has been traced. At a few points the data which relates to the importation of the disease is obscure; but as each of these localities is upon the line of public travel, it is safe to affirm that these instances present no exception to the fixed laws by which the progress of cholera is governed.

In witnessing and noting the effect produced upon the public when the disease of the past summer was developed, the writer was profoundly impressed with several facts.

I. The eagerness with which the public mind fastened upon any thing which could give information of cholera. This was not alone exhibited by those individuals who were influenced by personal fears, but by noble men and women, who lavishly poured out their substance as well as sympathy upon the sick and dying.

II. The terror which was exhibited in some localities on the development of the disease, and the inefficient means adopted, from a want of knowledge, to prevent its spread.

III. The utter impossibility of instituting proper sanitary regulations in a cholera district *after* the disease had become epidemic.

Deeply impressed with these facts, and with the train of thought to which they lead, the following outlines of the etiology of cholera, and a statement of the sanitary precautions which should be adopted to prevent the development and spread of the disease, have been prepared. Scarcely a doubt exists, judging from past experience, that cholera development can be controlled by sanitary measures, and that in isolated cases the disease can be stamped out by the proper use of disinfectants. But how powerless are sanitary officials in communities where the alarming ignorance and carelessness of individuals favor the development and spread of this most fatal disease!

When the authorities of inland towns as well as of large cities are convinced of the efficiency of hygienic regulations in protecting the health of communities intrusted to their care; when the members of such communities are possessed of sufficient knowledge of the disease to enable them to perform their individual duties *before, during, and after* an epidemic; then may scientists who devote their attention to the preservation of the public health hope to effectually enforce such measures as may check cholera as effectually as vaccination has checked small-pox.

That the death-march of cholera has not been arrested,

that again the disease has advanced to the Atlantic coast of Europe, that again the British islands have been invaded, that again the disease has been brought to New York harbor, renders it necessary that the possible development of cholera in America during the ensuing year should be met by every sanitary engine of destruction which it is within the power of the public to employ.

On the 30th of September, 1873, four cases of cholera were reported to have reached Liverpool by direct importation from Havre.\* On the 7th of October of the same year a case of cholera was discovered on a ship from Caen, which had passed Gravesend, on the river Thames; and during the fall of the same year one Havre and two Hamburg steamers brought the disease into New York harbor. In each of these instances the disease was vigorously stamped out at the quarantine.

The events of the next few months will determine whether the United States will again become inflicted with the disease from European importation, or whether the poison from which the disease is developed has remained dormant in localities which were affected during the past year, to be redeveloped in its full malignant power at a fitting season.

What is cholera? This question—so often asked, so often answered—has been ably met by Macnamara, from whom we quote in detail:

“Cholera is a disease which is generated at all seasons of the year among human beings inhabiting certain parts of India. It is capable of being disseminated over the world through the instrumentality of the fomites of those who suffer from the disease, though it may be only in the mild form usually described as cholérine. Cholera has a predilection for persons whose general health has been impaired from defective hygienic circumstances, from disease, want of proper food, or any similar cause. In the same way depression of the nervous force, by inducing an abnormal condition of the intestinal secretions, whether permanent or temporary, renders an individual peculiarly liable to an attack of cholera.

“The seizure is characterized by nausea, faintness, and a feeling of oppression in the præcordial region, griping pains in the abdomen, frequent watery purging

\* *Medical Times and Gazette*, October 4 and 11 and November 1, 1873.



(the stools being alkaline when passed, and in appearance resembling rice-water), constant vomiting, suppression of urine, and profuse perspiration; the skin is inelastic, and that of the hands and feet shriveled and dusky; the eyes are sunk and the features pinched; cramps are felt in the limbs; there is difficulty of breathing, intense thirst, excessive restlessness, rapid, small pulse, and suppressed voice; the external temperature of the body sinks below 38° F., and a peculiar sweetish, sickly odor (fishy) is exhaled from the body, breath, and dejections.

"If left to nature about one half of those attacked with cholera recover of themselves, reaction supervening, and often being accompanied with fever, and not unfrequently with suppression of urine and various complications; or the disease may terminate within a few hours from its commencement in fatal collapse." \*

A careful study of the various epidemics of cholera amply demonstrates the following facts: † that cholera, or that which produces cholera, is portable; that the poison may be carried from an infected locality to one that is healthy, and that in the latter the disease may be developed and assume a malignant epidemic form; that the disease advances in a general westward course through the world, and invariably follows the lines of travel; that the most active agents in its distribution are individuals who, having become infected, it may be insensibly, at a point where the disease is epidemic, pass over the ordinary lines of travel, and place a greater or less distance, according to the length of the period of incubation and the rapidity with which the journey is performed, between the point of original infection and the localities at which they establish foci of disease; finally, that the cholera poison may be carried from an infected point to a healthy community, in which the disease may become epidemic, while the individual who has acted as the porter of the disease enjoys an entire immunity.

\* Treatise on Asiatic Cholera, C. Macnamara. Churchill & Sons, London.

† Science and Practice of Medicine, Aitkin, Amer. ed., p. 620; Principles and Practice of Physic, Watson, Amer. ed., p. 916; Text-book of Practical Medicine, Niemeyer, translation; Notes on Asiatic Cholera, J. C. Peters, Van Nostrand, N. Y.; Cholera in Insular Positions, Smart, Lancet, May, 1873; Report on Epidemic Cholera, Circular No. 5, S. G. O., Washington, 1867; Report of English Army Medical Department, London, 1871; "Channels through which Cholera is Communicable," Murray, British Medical Journal, August, 1873.



Through the kindness of Dr. John C. Peters, who possesses a most accurate knowledge of the habits of cholera and of the topography of its favorite routes, whose maps are monuments of his indefatigable devotion to the study of this disease, we are able to trace in Asia and Europe the steps of the epidemic which burst upon the United States during the summer of 1873.

The great epidemic of cholera in the years 1865, '66 and '67 left Russia with only eighty-three cases of the disease in 1868. These cases occurred in Kiev, the holy city of Russia, situated on the river Dnieper, and to which city over fifty thousand pilgrims come annually. In 1869 there were nine hundred and eleven cholera cases in Russia, which spread from Kiev north-east toward Orel and Moscow, and down the river Dnieper to Odessa. In the mean time the great Hurdwar epidemic of 1867, in Northern India, had been carried along the north Persian route, by way of Jelalabad, Cabul, Herat, Meschid, to Asterabad, upon the Caspian Sea, across which it was conveyed by steamers to Baku, and from thence overland, by way of Tiflis, to Poti, upon the Black Sea. In 1870 cholera was developed at Taganrog, on the sea of Azof, and at Kertch, in the Crimea, and spread through Russia. In consequence of this importation, in 1870, in Russia twenty thousand one hundred and forty cases occurred.\*

In 1869 a fresh outbreak of cholera occurred at Peshawer, in the Punjab. Again the disease was conveyed over the North Persian route toward Europe. At the same time it was carried down the river Indus, infecting all towns upon its banks, to the city of Kurrachee, at the mouth. From this point the disease was carried up the Persian Gulf to Bushire; from thence overland, by way of Shiraz and Ispahan, to Teheran, at which city the North and South Persian routes come together.

\* Practitioner, Oct., 1873, p. 308; Brit. Med. Jour., Aug., 1873, p. 220; Sixth Annual Report of the Sanitary Commissioner with the Government of India.

The ports of the Black Sea were again infected in 1870. The epidemic in Russia was re-enforced, and in 1871 there were three hundred and five thousand two hundred and twenty cases reported, and the disease was carried into Poland. By means of the travel upon the rivers Niemen and Vistula, which rivers are connected with the Dnieper by canals, cholera was carried to Königsberg, Stettin, and Dantzic, on the Baltic. In these cities the epidemic lasted during 1871, '72 and '73. In 1872 Prussia and Austria were invaded. Again, in 1873, did the disease appear in the Baltic cities, and spread through Europe to England.

In February, 1873, cholera was reported in the city of New Orleans, but whether it was imported from Hamburg or from Rio de Janeiro remains to be solved.

The epidemic of cholera, as it affected Garrard County, Ky., presents a notable instance of the portability of the disease.

On the 10th day of August, 1873, a gentleman arrived in Lancaster, having traveled on horseback from Russellville, Tenn., which town prior to his departure was infected with cholera. A few hours after his arrival in Lancaster he was attacked with the disease. No care was taken to disinfect the dejections or in any way to isolate the case. He was visited by his father-in-law, who remained one night in the sick room; the next day was taken with cholera, from which he died in a few hours. The second victim to the disease was a negro man, who had been employed to nurse the case. From these cases the disease spread and became epidemic.

The report of Drs. Berry and Wilson,\* gentlemen who responded to the call of the suffering citizens of Lancaster, having been questioned by some ill-disposed individuals, we fully indorse, from personal observation, the correctness of the statement of these gentlemen.

By the majority of authorities the period of incubation

\* A History of Cholera at Lancaster in 1873, Amer. Prac., Oct., 1873.

of cholera ranges from thirty-six hours to six days. Pettenkofer, in 1853, demonstrated that in some instances this period might be prolonged to twenty-one days. Taking into consideration these facts and the rapid rate of modern travel, it is in no way surprising that cholera strides across oceans or continents, and is developed almost simultaneously in widely separated localities.

The late epidemic fully illustrates this fact. During the months of February, March, and April, 1873, cholera was in the city of New Orleans, but no point outside of that city was known to have been infected. During May nine distinct points, widely separated, but all within direct communication with New Orleans, were infected, and from these points the course of the disease can most easily be traced.\*

Central Kentucky furnishes several notable instances of the immunity from the disease which occasionally individuals enjoy, although they may be the carriers of the infection to others.

Dr. L. S. McMurtry, of New Orleans, relates a case which came under his observation during a visit to Garrard County. A negro woman was attacked with cholera September 2, 1873, and died after fifteen hours' illness. She had lived in a retired locality, had not been from home all summer, had been exceeding careful as to her diet, and her house was a comfortable cabin. No cases of cholera had occurred in the vicinity. Her death was followed by the development of choleraic symptoms in all the members of her family, from which two children died. No cause could be assigned to this outbreak until it was discovered that a boy from the infected district in Lancaster, which town was nine miles distant, was living in the house; that he had arrived a few days prior to the attack of the woman, and that since his arrival he had been in all respects one of the family. There can be no doubt that he was the infecting agent, although he personally escaped the disease.

Dr. S. P. Craig, of Lincoln County, Ky., in describing the outbreak of cholera in the town of Stanford in that county, states "that cholera was developed, August 29, 1873, in a portion of the town occupied almost exclusively by negroes, and the disease was traced to a filthy privy and cesspool in rear of the houses in which the first cases occurred. Prior

\* Publication of the American Public Health Association.



to this outbreak several refugee negroes from the infected district in Lancaster arrived at these houses, and remained until the disease was developed in Stanford. They are known to have used this privy. None of this party were attacked with cholera."

These are by no means isolated instances, but are fully corroborated by history of other epidemics.

The distribution of cholera by individuals, the length of time to which the period of incubation may be extended, and the fact that individuals may convey the poison without themselves becoming the subjects of the disease, fully refutes the theory "that cholera is conveyed by some mysterious agency, which enables it to overleap all barriers and suddenly to develop itself in distant and isolated communities."

Endemic in that country which is watered by the Ganges and its tributaries, following the lines of travel, frequenting the large social and religious gatherings of the inhabitants, cholera ever strives in their dispersion to find an outlet from the country. Grand highways of pestilence have been formed, and the trails of the disease are found over Asia, Europe, America, and the eastern coast of Africa. Nor have its ravages been confined to continents; for the islands of the Indian and Atlantic oceans, of the East Indian, Australian, and Polynesian archipelagoes and those of the Mediterranean Sea, have all undergone severe epidemics.\*

Ever unsuccessfully striving to acquire a local habitation in the Western World, thousands of miles of land and water are crossed. The severity of Russian and Canadian winters are withstood in the close, hot, ill-ventilated cottages of the peasants; but at last the poison-producing power dies, the disease outside of its natural habitation becomes extinct, is no more capable of reproducing itself. But the great highways are still open, and presently the warning is given that once again cholera has commenced its death-march.

\* Dr. Smart, Cholera in Insular Positions.

The only recorded instance which will bear a searching investigation into all its details of cholera originating outside of Hindoostan is that related by Estrazulas of the endemic of 1866, '67 and 68 in South America.\* In this instance there was a combination of all the well-known "factors" of cholera within the lines of the opposing armies during the Paraguayan war. The disease, once developed, obeyed the known laws by which its course has always been governed, and gradually was carried through the Argentine Confederation and Uruguay, reaching the last-named only after the third outbreak.

The theory of Estrazulas, that cholera originated in Paraguay, finds an opponent in Dr. Rego, president of the Imperial Academy of Medicine at Rio de Janeiro,† who shows that before the disease occurred in Paraguay the cities of Pernambuco, Guanzy, and Rio de Janeiro had been infected with cholera; that prior to the outbreak in Paraguay a troop-ship left Rio for the seat of war; when two days out from port the troops on this vessel were attacked with cholera; that after entering the Parana River, but before coming within the lines of the army, she was turned back and placed in quarantine at St. Catharine, Brazil.

In the review of Dr. Rego's work by Estrazulas much stress is laid upon seeming inconsistencies in the narrative of events; but the reviewer seems to have overlooked the fact, in his anxiety to establish his "endemic theory," that the infected troop-ship, although she did not come within two hundred miles of the locality in which cholera was developed, still was on the Plata and Parana rivers, and was in communication with other vessels for some time before she was turned back to quarantine.

According to Dr. Smart,‡ cholera is endemic on the Malay

\* Epidemic Cholera in South America, Estrazulas; American Journal Medical Sciences, July, 1873.

† Review American Journal Medical Sciences, October, 1873.

‡ London Lancet, March 22, 1873.

Peninsula and the islands of the Asiatic Archipelago, but he is able in each outbreak to trace the exciting cause to importation.

During the past year Pelikan and other Russian sanitarians startled the medical world by announcing their conclusion that cholera had become endemic in Russia; that the last outbreaks of the disease in Eastern Europe were not from new importations from Asia, but were from the seeds of the disease having remained latent from former epidemics.

The evidence upon which this opinion was based seemed at the time it was published to be unanswerable; but at the recent meeting of the British Medical Association Dr. Radcliffe,\* representing the Medical Department of the Privy Council, demonstrated the erroneousness of the conclusions to which Pelikan had arrived. It can be conclusively shown that although the disease lingered at Kiev, the holy city of Russia, during the years 1865, '66, '67 and '68, it had been constantly re-enforced by successive cholera arrivals by way of the Red Sea and North Persian routes.

The mass of evidence which has been collected by careful observers† in the history of cholera may be summed up under a few propositions.

1. *That cholera is a contagious disease, resulting from an organic matter, which entering into the alimentary canal acts upon and destroys the epithelium.*

Without entering into a description of the pathological conditions induced by cholera, the report of the post-mortem examinations made by Hayem, of Paris, in 1873 are cited as indicative of the results obtained by previous observers:

\* Medical Times and Gazette, July 12 and August 9, 1873.

† Lecture on Epidemic Cholera, Professor Alfred Stillé, University of Pennsylvania, Philadelphia Medical Times, July, 1873; Fauvet on Cholera, Medical Times and Gazette, October 18, 1873; Memorandum on the Propagation and Prevention of Asiatic Cholera, William Rudd, M. D., Clifton, 1861; Watson's Practice of Medicine, op. cit.; Niemeyer's Text-book of Medicine, op. cit.; Aitken's Science and Practice of Medicine, op. cit.



"The only organs constantly involved are the intestines. The capillaries, the different layers of the epithelium, the sets of glands, and the villi had all undergone certain changes, but differed in no way from the changes observed in ordinary intestinal catarrh. In the blood there was found an increase of the white corpuscles and small, fragmented globules. These are explained by the stasis of the blood in the algide period and the decrease in the proportion of water. No microscopic characters peculiar to cholera are found."\*

Jaccoud, in his admirable paper on Asiatic cholera in *Pathologie Interne*, translated by Prof. Ochterlony, of Louisville, states: "The other lesions observed in cholera and the symptoms arising from them are not immediate effects of the poison, but necessary consequences of the primary lesions, and in a great measure of mechanical origin."†

*2. That the respiratory and digestive organs are the avenues by which individual infection is accomplished.*

The majority of observers unite in the opinion that by the medium of infected air, water, and food the cholera poison gains access to the system. Dr. Ball, of the Hôtel Dieu, thinks that although the digestive tube is the habitat, as it were, of the choleraic poison, yet the lungs are the principal viæ of infection. Dr. Murray, in his admirable paper on the "Channels through which Cholera is Communicable," records his opinion that in some instances the cholera poison enters the system through the skin; and further states that the profuse cold perspiration of a cholera patient, from its peculiar and characteristic odor, is an evidence of the elimination of the disease by the same means.

*3. That the active agents in the distribution of the cholera poison are the dejections of persons who have become infected,*

\* London Lancet, October 11, 1873.

† Richmond and Louisville Medical Journal, August, 1873.

Aitken's Practice of Medicine, op. cit., p. 623; Niemeyer, Text-book, op. cit., p. 646; Manual of Practical Hygiene, Parkes, Am. ed., 1868, p. 62; Jaccoud, Asiatic Cholera, op. cit., p. 8; Snow's Report on the Cholera Outbreak in Saint James's Parish, London, Churchill, 1855, p. 119; Medical Times and Gazette, October 18, 1873; British Medical Journal, August 23, 1873.

*or of those in whom the disease is fully developed ; that in these dejections there exists an organic matter which in a certain stage of decomposition is capable of reproducing the disease.*

That the rice-water discharges are not simply the watery portions of the blood, as is popularly believed, is demonstrated by chemical examination.

Dr. Thudicum, who has made a careful quantitative examination of the dejecta of cholera patients, finds that these fluids contain "vibriones, cells from the surface of the intestines, granular *débris* of cells, mucin, modified hemochrome, albumen, an albuminous body giving a rose-pink reaction, butyric acid, acetic acid, ammonia, leucine, and some inorganic salts. The discharges in a state of active decomposition evolve nitrogen, then hydrogen, and ultimately nothing but carbonic acid." \*

The most careful and patient investigations have failed to determine the presence of any fungoid growths in cholera dejections that differ from those grown in the dejections of patients who may die from other intestinal diseases.

Macnamara states that the rice-water discharges are always alkaline ; that soon after they are passed they separate in the vessel into two portions, the flocculent matter sinking ; that the rapidity with which this takes place is an evidence of the severity of the attack ; for if this separation takes place very speedily, it indicates the complete death and disintegration of the organic matter, and an unfavorable termination of the case may be predicted. He says: "The flocculent matter of the stools is composed of epithelial cells and the mucous lining of the intestinal canal in various stages of decomposition. The epithelial cells, disintegrated and changed so as scarcely to be recognized under the microscope, are full of molecular matter, precisely as in other instances of decomposing organic matter, but no new chemical elements can be discovered."

\* Macnamara, *op. cit.*, p. 351.

It is from this organic matter, in what is termed the vibronic stage of decomposition, that Macnamara insists that the dejections of cholera receive their contagious properties; and he bases his opinion upon the results obtained from the experiment hereafter noted.

If a sufficient amount of the fresh dejecta of a cholera patient to produce a slightly opaline tinge be added to water, and the fluid be exposed to the full rays of a hot sun, at the end of twenty-four hours "the vibrio stage of decomposition or change in the organic matter is in full force, the surface of the fluid being covered with large vibriones. During the next twenty-four hours no additional changes will be observed, but on the next ciliated infusoria will have appeared in the fluid and replaced the vibriones, that are no longer to be found in motion, but collected together at the bottom of the vessel. In a few days longer bubbles of gas will rise to the surface, and the sides of the vessel will be lined with confervoid growths." \*

Prof. Thiersch fed white mice upon the dejecta of cholera patients. Strips of paper were saturated in the dejecta at various stages of decomposition, with the result that all the animals who ate of the discharges which had been exposed to the air for from two to six days were seized with diarrhea, suppression of urine, and after death the presence of large quantities of an odorless, colorless liquid was detected in their intestines.

In 1866 Dr. Burdon-Sanderson † confirmed these experiments of Thiersch and added much interesting data. He demonstrated that the liability to attack was greatest when the papers from the third and fourth days of decomposition were eaten, much less and nearly equal as regards the second and fifth days, and least of all as regards the first day. The

\* Macnamara, *op. cit.*, p. 396; Lionville on the Propagation of Cholera, *Medical Times and Gazette*, October, 1873.

† Communicability of Cholera, *London Lancet*, Dec., 1867, p. 770.



fluid contents of the intestines of mice that had died from eating human cholera dejections was collected and subjected to the same tests, when it was found that it communicated "a malady indistinguishable in character from that developed by the human dejections in other animals of the same kind"

These experiments have been fully corroborated by those of Thudicum, Marshall, Meyer, and others; but in the hands of Macnamara \* they seemed to have failed, while good fortune gave him the results of an accident, unfortunate to the individuals involved, but of incalculable value to science.

"In 1861 a small quantity of the dejecta of a cholera patient was known to have been accidentally washed into a vessel containing water. The mixture, after being exposed to the heat of the sun for one day, was swallowed by nineteen men. They all remained perfectly well during the day; ate, drank, went to bed as usual, and slept as usual. One of them on waking the next morning was seized with cholera. The remainder of the party passed through the second day perfectly well, but two more of them were attacked with cholera the next morning. All the others continued in good health till sunrise of the third day, when two more cases of cholera occurred. The other fourteen men escaped the disease. That the water of which they drank had been contaminated with organic matter was first discovered from the appearance of vibriones on its surface, and this ultimately led to the detection of all the circumstances. Cholera was not prevalent at the time, nor had it visited the locality at which this occurred for several years."

This occurrence led to a number of experiments, which at this time can be but briefly noticed, and from which it was determined that if the alkaline cholera dejecta, even in a stage of decomposition, be rendered acid, the molecular action is instantly destroyed; that if the dejecta of a cholera patient are mixed with the healthy gastric juice of carnivorous animals, the molecular changes are arrested and the organic matter appears to be digested. Reasoning from these experiments, it is safe to assert:

I. That the dejections of a cholera patient swallowed, before the stage of vibronic decomposition has taken place, by a healthy person will be so acted upon by the acids of the stomach that molecular decomposition will be impossible.

\* Macnamara, *op. cit.*, pp. 196, 381, 395.

II. That in a healthy subject, the functions of whose stomach are regularly and properly performed, the action of the gastric juice will destroy the molecular process of decomposition, and no infection will result.

III. That if a large quantity of water infected with cholera stuff is swallowed, a portion will inevitably pass at once from the stomach to the intestines, and as their contents are alkaline the process of infection will quickly take place; or if this contaminated water be drunk while the individual is fasting and the secretions of the stomach are alkaline, the gastric juice will not be sufficiently powerful to arrest the decomposition, and infection will result.

The experiments upon which these assertions are based we advance as sufficient reply to and explanation of the circumstances which, in 1833, led to the assertion that cholera was not a contagious disease. So universally was this theory accepted, and so conclusive seemed *the facts that individuals had tasted and drunk of cholera dejections, had fed the same to animals, and had even inoculated themselves with the rice-water discharges, and yet all escaped with impunity*, that at the present day the dogma of non-contagion is adhered to by many.

It is further urged against the theory of the contagiousness of cholera, the supposed immunity to the disease enjoyed by the attendants upon the cholera sick.

Is not this a question worthy of careful consideration? We are profoundly impressed with the belief that, proper precautions having been taken, cholera attendants may enjoy the most perfect security from the infection. But the question is, are those attending upon a case of cholera safe when the disease and its products are left to nature alone?

*During an epidemic of cholera all the members of a community are not attacked.* No epidemic upon this continent has been entitled to be denominated pandemic. *An epidemic of cholera does not occur in every locality contaminated by the arrival of cholera patients.*† It is particularly those whose systems are vitiated by other disease; those who are suffer-

\* Macnamara, op. cit., pp. 383, 384, 402.

† Jaccoud, op. cit., p. 8; Macnamara, op. cit., p. 194; Physical Course of Epidemic Diseases, A. H. Howe, Churchill, London, 1865.

ing from depression of the nervous force from any cause, but especially from that depression which follows excessive fatigue, debauches, or fear; those who live in open violation of all hygienic laws; those impoverished by want, who are particularly liable to the disease. We have shown how the system of a healthy person may resist the invasion of the disease, but these individuals have nothing to resist with, and therefore succumb.

It is unnecessary to refer to Indian or European epidemics to illustrate the truth of these assertions. The epidemic of 1873 in the state of Kentucky furnishes many marked examples, and from our notes collected for a history of the epidemic the following cases are taken:

1. A young man eighteen years of age, a native of Nelson County, was infected in Marion County, where he had been in attendance upon a friend who died of cholera. On the 20th of August he returned to his home and was attacked with the disease. Many hours passed before a physician could reach him, and his friends ignorantly emptied the dejections upon the ground near the house. The case terminated fatally after nine hours' illness. Upon the arrival of his physician a most careful disinfection was instituted; but all the decomposing dejecta were not reached, for six members of his family were attacked by cholera, and three died.

2. September 2d a young man twenty-six years of age died in Nelson County of cholera. On the 31st day of the previous August he had visited the house of a relative in Marion County where there were several persons sick from cholera, and where no process of disinfection had been instituted. During his visit he sat upon a porch which was quite near to a mass of *debris* upon which all the cholera dejecta had been emptied; and upon this porch he ate his dinner. That evening he left for his home; and it is positively ascertained that in no other way did he come in contact with contagion, yet in two days' time we find him sickened and dead.

Another instance is strikingly illustrative:

3. On the 25th of August, 1873, a lady died in the city of Bowling Green of cholera. Her body was removed to Louisville for burial, and the coffin having been opened the body was viewed by her family. Within a few days four cases of cholera occurred in the family, from which three died, and all the remaining members suffered more or less violently from diarrheas.

4. *That cholera dejecta coming in contact with and drying upon any object, such as articles of furniture, bedding, or clothing,*



*will retain indefinitely its power; and that under favorable circumstances the process of decomposition will at once commence.*

To demonstrate the value of the facts on which this proposition is based, Macnamara mixed a fresh cholera dejection with sand and allowed the mixture to dry rapidly under the heat of the sun. After a lapse of seven years "a small quantity of this earthy-looking stuff was placed in water and exposed to the sun, when it could not be distinguished from a fresh cholera stool." \*

With the knowledge obtained from this experiment we are able to understand the numerous instances upon record of persons being attacked with cholera after wearing the clothing or sleeping in beds previously used by cholera patients.

To refute the theory of contagion as illustrated under this proposition, the fact is brought forward of cholera clothing having been washed with impunity on the part of those performing the work. Such, however, are isolated instances, and *are accounted for by the fact that the susceptibility of individuals to cholera poison varies so greatly, and that the number of careful, healthy persons who are physically liable to the disease is always small in every community.*

5. *That through the atmosphere of infected localities the disease is frequently communicated to individuals.*

Upon this point the investigations of Niemeyer induced the following record of his views:

"The cholera poison is rarely taken into the system by drinking water containing it. As a rule, it undoubtedly enters the nose and mouth with the air, and is swallowed with the saliva. Using infected privies is so dangerous, because they are the favorite lurking-places for cholera-germs, and the gases arising always contain dust-like particles."

The results of Pettenkofer's theory are that the emanations from infected soil impregnate the atmosphere with the cholera poison. It is indisputable that when cholera dejections are

\* Macnamara, op. cit., p. 398.

deposited in impure privies, cesspools, or drains the poison is propagated and diffused. Adair County, Ky., furnishes a marked instance.

In the rear of a livery-stable situated in the town of Columbia was a privy, the vault of which was filled to overflowing with putrid excrementitious matter, and the ground in its vicinity was saturated with the drainage from it. During the months of July and August some attempts were made to cause this privy to be disinfected and cleaned. These attempts at sanitary reform were resisted by the proprietor of the stable. Late in the month of August a negro boy, who had become infected with cholera in another county, came to this stable, suffering from diarrhea, and made use of this privy. The diarrhea became cholera, and he died; and from that infected privy an epidemic of cholera spread, which cost that community twenty-six valuable lives.

*6. That water contaminated by surface-washings, by drainage from neglected sewers, cesspools, or privies, may and does become contaminated with the cholera poison.*

Water undoubtedly performs a most important part in the diffusion of cholera. Macnamara insists that an epidemic outburst of cholera can only occur through the drinking-water of the place becoming contaminated with cholera matter.\*

The investigations of Dr. Snow, in London, during the epidemics of 1849, 1853, and 1854 prove that cholera may be actively distributed through the medium of drinking-water.

The persistence of a cholera epidemic in Russia during the winter season was only partially accounted for by the habits of the Russian peasants, the construction of their houses so as to exclude all air, the faulty heating apparatus, etc., until Dr. Routh pointed out that in the Russian settlements every thing is thrown out around the dwellings; and that, owing to the intense cold and the great expense of transporting drinking-water, the inhabitants are in the habit of drinking the water from melted snow; that the snow used for this purpose has been frequently that upon which the

\* Macnamara, *op. cit.*; "Mode of the Communication of Cholera," Snow, Churchill, London, 1855; "Influence of Impure Water in the Diffusion of Cholera," British Medical Journal, August, 1873.

cholera stools have been thrown, and that by this impure drinking-water the epidemic is prolonged there can scarcely be any doubt.

The epidemic in Central Kentucky during the past season furnishes a striking illustration of the power of drinking-water in disseminating the disease :

Several isolated cases of cholera had occurred, in the town of Lebanon, near to a small creek which forms one of the drains of the town. A few days after their occurrence the Marion County Fair was held upon the grounds near Lebanon. As the water-supply was less than the demand, the deficiency was supplied from the town. Unfortunately a well was selected on low ground and quite near to the banks of this creek. On the second day of the fair a violent rain-storm deluged the country. The creek was filled to overflowing, and it was impossible that the surface-washings should not have infected this well. On the third and fourth days of the fair the water of this well was served as usual; and on the night of the last day (August 31st) cholera, malignant in its type, was developed in all localities inhabited by those who had visited the grounds and drunk the water.

Great stress is laid upon the fact that subsequently the water from the same well was used by individuals with impunity, for which certainly the theory of vibronic decomposition, which has been so fully noted, offers a sufficient solution.

*7. That without a combination of all the well-known factors of cholera the disease can not originate de novo.*

Masses of decomposing *débris*, animal or vegetable, can not of themselves produce the cholera poison. They are the hot-beds in and on which the cholera excretions having been placed the poison is reproduced with fatal rapidity.

Peters points out as the principal factors of an epidemic of cholera :

1. An atmosphere impregnated with the products of fermenting human excrement.
2. An elevated temperature, with a still, stagnant, and peculiarly oppressive condition of the atmosphere.
3. Such meteorological conditions as have a marked tendency to favor the chemical decomposition of organic substances.
4. Lowness of site, swampy ground, moist soil, decomposition of vegetable matter, and all those causes which tend to produce bilious and remittent fevers.
5. Foul camping-grounds, filthy streets and yards.
6. Impure water.
7. Bad, spoiled, or defective food.

The summary of cholera causes by Dr. Montgomery may be added to the list of Peters. It is as follows:

1. Undue exposure to the vicissitudes of climate, especially during cold nights following hot days.
2. Physical fatigue and nervous depression.
3. Undue abstinence or deprivation of food.
4. Excesses in eating, drinking, and licentiousness.
5. Vitiating atmosphere from all causes.
6. Direct exposure to the contagion of disease.

The summaries given agree with those of all observers who have devoted sufficient study to the disease to entitle them to be recognized as specialists.

During the past year Dr. G. E. Nicholas, the medical officer of health for Wandsworth, England, advances the theory that flies form one of the most, if not the most, common and direct means of the propagation of cholera. This opinion is based upon the argument of Prof. Leidy, of Philadelphia, and Dr. Nicholas's personal observations. The communication concludes with the remark that "the diarrhea season is generally believed to be associated with the fruit season, and perhaps justly so; but then it is the fly season also, and the fruit may not be *per se* the cause but only the vehicle of the poison communicated by the fly."\*

Since the preceding pages were prepared the following translation of the paper of Högyes has appeared in the current medical journals. It is so strongly corroborative of the statements of Thiersch, Sanderson, Macnamara, and others, which have been noted in detail, that the translation, as it appeared in the Medical Record of January 15, 1874, is hereby transcribed as additional evidence of the truth of the facts elicited by earlier observers. The italics are our own.

"ACTION OF FRESH CHOLERA DISCHARGES UPON ANIMALS.—An interesting series of experiments with the discharges from cholera patients was made during the latter part of July of this year (1873) by Andreas Högyes, of the University of Pesth, a report of which is published in the *Centralblatt für die Med.*

\* London Lancet, November 15, 1873.



*Wissensc.*, No. 50. The points which it was sought to determine were, in brief, the following:

"I. *Do fresh cholera discharges operate injuriously upon the organism of lower animals, and under what manifestations?*

"II. *Does an artificially excited catarrh of the stomach and bowels increase the susceptibility to the action of the cholera discharges?*

"III. *Can a current of air bear away particles from the discharges which are capable of affecting the organism injuriously, and what difference is there in this respect between non-disinfected and disinfected cholera discharges, simple diarrheal discharges, and putrefying fluids?*

"IV. *Are cholera discharges freed from their form-(living) elements still able to act upon animals?*

"V. *What portions of the disinfected or non-disinfected discharges does the air-current bear away, and what is the further destiny of these form-elements when they fall upon a neutral medium or one adapted to their development? In what manner do these elements modify the action of this medium?*

"To decide the first and second questions, fresh cholera discharges were given to healthy dogs, and to others in which an artificial catarrh of the stomach and intestines had been excited by the administration of croton-oil, sulphate of copper, etc. *Both dogs were made sick, with frequent vomiting and diarrhea; but while the previously healthy animals recovered in three or four days, those in which a catarrh had been excited died the day following.*

"To determine the third question, rabbits were placed under a bell-glass and exposed to air which had become impregnated as desired from either cholera discharges, disinfected or not disinfected, diarrheal discharges, or putrefying fluids. Two rabbits, in one of which a bronchial catarrh had been produced by inhalations of ammonia, were exposed for twenty-four hours to air from cholera discharges not disinfected. *On the third day following violent purging set in, and both animals became soon cold and collapsed. The one in which a bronchial catarrh had been excited died first, and the other five hours later. A rabbit exposed for twenty-four hours to air from disinfected cholera discharges remained well; another exposed for an equal length of time to atmosphere impregnated from simple diarrhea stools escaped uninjured; while another which remained for twenty-four hours in atmosphere contaminated from putrid fluids, though at first made insensible, afterward recovered without harm.*

"As to the fourth point, cholera discharges were injected into the jugular veins of dogs and guinea-pigs; the discharges in one case having first been freed from their form-elements by thorough filtration and in the other not. *The effect in both instances was the same.*

"To determine the final points, a current of air was made to pass through fresh cholera discharges, both disinfected with carbolic acid and not disinfected, and then conducted through two separate vessels, which contained, respectively, an indifferent fluid-medium, and one adapted to the support and development of any living forms which the current should bring to it. The two fluids used were distilled water and the fluid of Cohn. In a short time, in the fluids communicating with the undisinfected discharges, a considerable number of form-elements had accumulated, which proved to be almost exclusively the bacteria

which are usually found in putrid animal fluids. In twelve hours Cohn's fluid had become clouded and milky; in twenty-four hours it was covered with a thick bluish-green fungous slime, and emitted a foul odor. The distilled water remained clear. *Both these fluids, when injected into the veins of dogs and rabbits, caused the same symptoms as after injection of the cholera discharges themselves.* This was also true of the fluid of Cohn after its fungous elements had been quite removed by filtration, showing that these elements are at least not the only source of infection. Similar experiments with discharges which had been disinfected with carbolic acid showed that the organisms which the air-current brought to Cohn's fluid were incapable of propagation. Upon injection of the distilled water and fluid of Cohn, after previous disinfection of the discharges by carbolic acid, only symptoms of carbolic-acid poisoning were manifested."

LEBANON, KY.

## CHOLERA HYGIENE.

Cholera having been demonstrated to be a contagious disease, which is spread by the dejections of individuals suffering from choleraic diarrhea as well as from the developed disease, it becomes a matter of vital importance to inquire what means may be employed to prevent or arrest the development of the disease in any threatened community.

*That the occurrence of cholera may be prevented by proper precautions, and that it may be stamped out when once developed, is most certain.\* To insure this grand result is necessary the concerted action of each and every individual. One careless or indifferent member of a community may not only render negative the wisest precautions, but may endanger the lives of all.*

The results obtained by experienced observers demonstrate that the means of prevention against a general epidemic of cholera are:

- I. *Quarantine ;*
- II. *Cleanliness ;*
- III. *Disinfection ;*
- IV. *Individual Habits.*

I. QUARANTINE.—With the subject of quarantine, from the geographic location of the territory to the inhabitants

\* Report on Epidemic Cholera, Circular No. 5, Surgeon General's Office, Washington, 1867; The Mecca Pilgrimage and the Cholera, Medical Times and Gazette, April 26, 1873; Prophylaxis of Asiatic Cholera (McCormac), British Medical Journal, August 23, 1873; Progress of Sanitary Science, British Medical Journal, October 25, 1873.

of which these pages are addressed, but little of interest presents itself. Cholera, following the great lines of travel, only reaches the interior of a continent after the note of warning has been sounded from one or other of the ports of entrance. At such points the subject is of vital importance; but the disease having escaped the cordon, and having become domesticated in any community, it behooves all within the lines of travel from that infected point to consider carefully and earnestly such means of prevention as the knowledge which sanitarians possess of the disease has placed at the disposal of the public.

II. CLEANLINESS.—Cleanliness in what? Cleanliness in every thing. To maintain the perfect sanitary condition of a large city trained minds are devoted and thousands of money are lavishly expended; but in the small interior towns, with some few bright exceptions, little or no attention is paid to the subject, each property-holder following the bent of his own mind. In these towns the streets and natural drainage sources are the receptacles of filth. The ground within and around out-houses is the depository of human excrement. The negro in his cabin is permitted to rival the pollutions of Jessore or Madras, while the only scavengers to be found are the hogs that roam the streets. The latter, after devouring indescribable filth, are presently served as articles of food.

To secure the best sanitary condition of a town, it should be the duty of the trustees to appoint an inspector, who should have at his command an efficient corps of laborers. By this inspector all that is detrimental to the public health should be removed.

To what should his attention be directed?

1. *To the condition of each house and its surrounding premises.*—*Débris* of all kinds should be collected in heaps and destroyed by fire. No rank vegetation, which too often conceals pernicious substances, should be allowed to stand, and



when cut down should be destroyed by fire. Out-houses of all kinds should be inspected. Privies, stables, chicken-houses, etc., should be cleaned and disinfected. The *débris* should be buried in such position as not to affect the water-supply. Dirty and damp cellars should be cleansed, ventilated, and disinfected.

The water-supply should be rigidly examined, and property-holders required to place their wells and cisterns in good condition. *Débris* should not be permitted to accumulate upon the ground. The well should be securely covered and closed. The sides should be banked up, so that the surface-washings may be from, not to, it.

Despite the theory of Pettenkofer, the action of the soil as a filter surpasses all others, and from a carefully-kept well pure drinking-water may always be obtained. If a privy-vault should be close to a well, or if a house or other drain should pass in its immediate vicinity, the walls of that well should be rigidly and frequently examined, and water taken from the bottom of the well carefully tested, lest contaminating drainage may occur; and all wells so situated that they must inevitably receive impure drainage or surface-washings must be closed in such manner as will absolutely prevent access to their contents. Localities which in a past season had been infected, and where systematic disinfection had not been instituted during the prevalence of the disease, should be most carefully cleansed. Every portion of the premises upon which cases of cholera had occurred should be reached by the disinfecting agents. It should be borne in mind that it is far more prudent to err from overzealous cautiousness than from negligence.

Individuals arriving in any community from a locality known to be infected should be at least subjected to a close surveillance. If their effects have been so situated that by any possibility they could have become infected, they should be subjected to sufficient disinfection. The individuals should

be required to use a carefully-disinfected privy until the uttermost limit which can be placed on the period of the incubation of cholera has been passed. For the efficient disinfection of clothing, etc., no plan proposed exhibits more favorable results than that of Dr. Ransom.\* In the use of this hot-air closet it was found that a temperature of 250° F. was effectual in destroying the contagion of small-pox.

A rigid house-to-house system of inspection, once having been established, should never be abandoned. An occasional inspection amounts to nothing. Eternal vigilance is the price of safety.

2. *To the condition of the natural drainage of the town,* water-courses and other natural drains should be kept free and unobstructed, and disinfectants should be constantly used throughout their length. The vegetation which almost invariably lines the streets of small towns and chokes the roadside drains should be removed; and then not left to decay in the center of the road, but should be removed beyond the town limits and there destroyed with fire. Ponds and pools of stagnant water within or near the limits of the town should be filled up; filled up not with the *débris* of the town, but with fresh earth, which is one of the most valuable disinfecting agents.

Cholera having appeared in a town, it is desirable that the authorities select an isolated building, which may be used as a hospital. The house selected should be sufficiently commodious to prevent overcrowding, and to admit of the separation of the convalescents from the sick. This building should be placed in the charge of a competent physician, who should be assisted by a corps of nurses, and the hospital should be furnished with all necessary appliances. To this building all cases of cholera which occur should be removed.

A distinguished physician of Nashville has pointed out

\* British Medical Journal, September, 1873.

that in an epidemic of cholera want of proper food and the privations to which the lower classes are always subjected during an extensive epidemic adds fuel to the fire, and his suggestions of immediate relief of their wants is worthy the consideration of all town authorities.

The general cleanliness of a town having been secured, there remains to be noted that of individuals. Scrupulous care of the person secures the removal of what may and often does prove the nucleus of disease. Personal cleanliness is best secured by a daily bath. In the sultry and oppressive weather in which cholera most frequently makes its dread appearance, the bath, as hot as can be borne with comfort, affords the most efficient relief that one can secure. A thorough soaping and rubbing of the body with a flannel cloth removes all effete matter from the skin, and the free use of hot water imparts a cooling freshness, a solace from which none may be debarred; and which, taken in the early morning, invigorates to meet the fatigues of the day, and at night encourages refreshing and strengthening sleep.

The under-garments should be frequently changed, and those which have been worn during the day should invariably be removed on retiring to bed. Clothing that has been worn through the day should never be exposed in the sleeping-apartments during the night-hours, and should be well cleansed and aired before being again used.

Trivial and unnecessary as such rules may seem, the observance of them will be found of incalculable value.

III. DISINFECTION.—What vaccination is to small-pox hygienic regulations are to cholera. The rigid observance of sanitary laws presents to this virulent disease a wall which is almost insurmountable. The foundation of this wall—this line of demarkation between health and disease, between life and death—is undoubtedly laid in disinfectants. If the port of entry is passed by cholera, if the embargo there laid upon



the disease has been insufficient to arrest its progress, it behooves each community to raise the wall for their own protection, and it is all the more necessary that the foundations are made sure.

The day has passed in which nauseous-smelling substances are looked upon as disinfectants. "To change the odor is not to disinfect. The odor produced by a putrescent animal mass may be covered, but the effete matter, the product of decomposition, is still present in the air that is breathed, although the nostrils, overpowered, fail to detect its presence." To borrow the words of Dr. Craig, "a true disinfectant must be antiseptic; that is, it must possess the power to destroy or to render inert the products of decomposition of organic matter or of morbid action in the living body through the agency of a reaction in which the disinfectant itself undergoes chemical destruction." \* Therefore that agent is the most acceptable and useful which destroys utterly and for all time the effete matter with which it may come in contact.

A study of these agents renders it necessary that some one or other of the classes into which they have been divided should be adopted; but as it is unnecessary in a paper of this character to enter fully into the study, and as we will endeavor to point out those which will be most valuable in the emergency of which we are treating, we will pass over the complicated classifications of Jeannel and others and adopt that of Dr. Craig.

1. *Destructive disinfectants*, "which act by oxidizing and consuming whatever organic matter they may come in contact with, attacking the more advanced product of putrefaction first."

2. *Conservative disinfectants*, "which destroy effluvia and organic matter when in small quantities, but are inert upon large masses."

\* Report on Disinfectants and their use in connection with Cholera, Circular No. 5, S. G. O., Washington, 1867.

The action of the agents which are classed under these grand divisions, and their application, will be considered when treating of the emergencies which demand their use, and those only will be noted that are attainable by all classes of individuals.

Experience has taught us that water, that indispensable element, is a most efficient agent in the diffusion of cholera poison.

The question naturally arises, can water which is contaminated with organic matter be detected, and when detected can it be rendered by any process of purification safe for human use? Facts based upon extended observation demand an affirmative answer. To detect impure water, or water which has been contaminated by organic matter, Rawlinson says:

"If the water from a certain well or tank be placed in a tall glass, covered and exposed to the sun, and after twenty-four hours a drop be examined under the microscope, we find its surface covered with molecular matter and vibriones. We may be almost certain that the organic matter from which these vibriones are formed is capable of inducing cholera, supposing it, of course, to have been derived from cholera ejecta." \*

This method of examination is certainly beyond the popular reach. Few individuals are skilled in the use of the microscope. Chemistry, however, affords a simpler means, and one which is within the reach of all.

Place a quantity of the suspected water in a glass vessel, and add, drop by drop, a solution of the permanganate of potash (which may be obtained from any chemist) until a pink color is imparted to the liquid. If after standing a short time the color disappears, it indicates the presence of organic matter. Add again the solution of the permanganate until the color is again produced. If the organic matter has all been decomposed, the water will after the lapse of hours retain the pink color; but if organic matter is still in solu-

\* Rawlinson "On the Best Method of keeping Water Sweet." Macnamara, op. cit., p. 498.

tion, the color will again disappear. The greater the amount of the salt decolorized before the water retains the pink color, the larger the quantity of organic matter present in the water.

Before proceeding to the subject of the purification of water it is well to examine into the sources from which water for domestic purposes is ordinarily obtained.

In communities not provided with a carefully-delivered water-supply the purest water that can be employed for domestic purposes is that obtained from securely-guarded wells and from cisterns which are supplied with rain-water. They alone can be protected from surface-washings. Cistern-water, however, must be as carefully examined and tested as the well-water. Rain-water, it is well known, may contain organic matter of animal or vegetable origin. Even when it has been collected in a clean glass vessel, before it has come in contact with roof or soil, it has been found to be impure from organic matters, etc., which it has derived from the atmosphere in its passage through it, when taken near inhabited places.

Snow and snow-water is much less pure than rain-water, for the crystals of which it is composed imprison the impurities of the atmosphere; and it is said "that snow frequently contains so much organic matter as to show confervoid vegetation under exposure to light." \*

The water of rivers, marshes, ditches, canals, and ponds is contaminated with organic matter derived from decaying animal and vegetable remains, and from *débris* of all kinds which necessity or surface-washings empties into them. Necessity demands that the water of large rivers shall be employed by the cities and towns upon their banks. In such instances all the aids which science affords are employed in the purification of the fluid before it is distributed for general use. But stagnant water, or the water of nearly dry streams or that of marshes, should never be employed for

\* Brande and Taylor's Chemistry, American ed., 1867, p. 138.

domestic purposes until it has been deprived of its deleterious constituents.

Spring-water may be contaminated from surface-washings or from organic matter with which the strata of soil through which it passes may be impregnated.\*

Impure water may be rendered serviceable and fit for use by boiling, which act precipitates most of the mineral constituents and destroys utterly all molecular matter.

Dr. Taylor, a returned missionary from China, reports that during a residence of many years among the Chinese no cases of cholera came under his observation; and this absence of the disease he attributes to the fact that tea is the beverage of the country; consequently nearly all the water which the inhabitants drink has been boiled.

By the process of filtration water may be thoroughly purified. Indeed so perfectly does the combination of boiling and filtration purify water that it is asserted that water in which cholera discharges have been mixed loses entirely its infecting properties on being subjected to these simple expedients.

Dr. Peters suggests an excellent filter for the poor "in one of the largest-sized common red flower-pots, suspended at a convenient height in a shady place, and having the hole in its base plugged with a sponge, so as to permit only an exceedingly fine stream of water to pass through; the sponge to be frequently washed." Filters containing the black oxide of iron are said to be efficient in removing organic matter from water.

Of such vast importance does this subject become that during an epidemic of cholera in any community each family should be provided with drinking-water only after it has been subjected to some such process. Water so prepared, to which ice is added, is not only harmless but palatable. Ice may be

\* Brande and Taylor's Chemistry, p. 133; A Manual of Practical Hygiene (Parkes), p. 16; A Treatise on Hygiene (Hammond), p. 216.



used with impunity, for it is one of the purest forms of water when taken from a deep lake or pond. Faraday demonstrated the fact that water in freezing deposits nearly all of its constituents, and that the unfrozen portions contain the impurities.

Not unfrequently individuals are placed in such positions that they are unable to procure water which has been purified by either boiling or filtration. The permanganate of potash, which has already been noted, now becomes invaluable. The action of this salt is explained by Dr. Craig as follows:

"When the permanganate is added in suitable quantities to impure water it converts the organic matter into carbonic acid, water, etc., undergoing itself a gradual decomposition, with the deposition of insoluble dextoxide of manganese." . . . . "A method which will destroy organic matter in water without adding to it any thing unpleasant or injurious is an evident desideratum at all times, and especially during the prevalence of cholera, and there is perhaps no method more effectual and convenient than that by treatment by the permanganate."

The practical application of this agent requires the use of from half a grain to one grain of the salt to the gallon of water, and about two hours are required for its action. In smaller quantities the solution should be added, drop by drop, until the pink color is evident. In a tumblerful of water but a few moments are required for its purification. At some of the Indian stations, where the water was offensive from decaying organic matter, a few drops of the permanganate purified the water almost instantly.

The peroxide of hydrogen, an antozone, is said to be still more efficient in the purification of water. It is a powerful oxidizer, and completely destroys organic matter with which it comes in contact.

The late Ashantee war called forth, among other notes of moment, the invaluable memorandum of Crooks on the purification of drinking-water. This observer demonstrates: 1. That the organic matter in impure water may be divided into three classes: (*a*) Matter in a state of putrefaction;

(b) Matter ready to become putrid; (c) Matter which is slow to decompose. 2. That the permanganate of potash acts powerfully upon organic matter of the first class, but that its power over substances of the remaining classes is not only slow but uncertain. 3. That a mixture—consisting of permanganate of lime, one part; sulphate of alumina, ten parts; fine clay, thirty parts—is the most effectual purification of drinking-water now known.

The use of impure water almost invariably results in the development of diseases of the alimentary mucous membrane, and of specific diseases, such as malarial and typhoid fevers and other affections; but simply impure water will not induce the disease known as cholera. To produce cholera from water it is essential that the *water must have received a portion of the organic matter from the dejecta of an individual who is infected with the disease.*

An unknown traveler infected with cholera may deposit his dejections in such position that the water-supply of a community will become infected. None knew of his arrival; his departure was not noted; therefore when days have passed, and cholera has been developed in persons who have used this contaminated water, the members of the community are at a loss to account for its development; but invariably a prompt and persistent inquiry along the line of infection will result in the detection of the individual who has scattered the disease.

It has been shown that privies, cesspools, and sewers, the receptacles of human excrement and of other forms of filth, become hot-beds for the dissemination of the cholera infection, when the dejections of an individual suffering from the disease are mixed with their contents. It has been further shown that the effluvia from such localities is impregnated with decomposing organic matter, and that when inhaled this organic matter becomes mixed with the saliva, is swallowed, and the disease is reproduced.

Experience, that mighty expression of power, has demonstrated that certain agents, classed under the general head of destructive disinfectants, will most effectually destroy this poison. Of these agents we will select but those whose efficiency has been well tested, and whose small cost places them within the reach of all classes—namely, *sulphate of iron, or copperas, lime, and charcoal.*

Each of these agents belongs to the class of destructive disinfectants; each acts promptly and powerfully upon organic matter, and a combination of the three procures a more powerful disinfecting agent for the purposes now under consideration. Dr. H. C. Wood thus describes the disinfecting action of copperas:\*

“It is antiseptic, but it also decomposes sulphureted hydrogen, precipitating sulphide of iron. It is decomposed by ammonia; the oxide of iron, a persistent, powerful ozonizing agent, being precipitated. It slowly but persistently attacks organic matter about it, oxidizing it, and being reduced to a sulphide of iron.”

The experiments of Eckstein, made in a privy which was in daily use by a large number of persons, confirmed the value which has been assigned to this agent.

Macnamara† found in cholera dejections which were treated with sulphate of iron the infusoria and molecular action was instantly destroyed and did not recommence. His experiments fully substantiate the statements made by Dr. Budd in 1866, and by Dr. Angus Smith in 1869.

Lime as a disinfectant is of value from its power of destroying organic matter by the process of oxidation, as well as by its powerful affinity for water. The chloride of lime as a disinfectant is claimed by Eckstein to be equal if not superior to sulphate of iron. Macnamara found, however, that although its presence in a cholera dejection arrested the action going on in the molecular matter for a time, it was very soon resumed. Charcoal acts as a mechanical disinfectant, entangling the organic matter in its meshes.

\* Phila. Med. Times, July 12, 1873, p. 655.

† Macnamara, op. cit., p. 401.

The most advantageous use which can be made of these agents is as follows: a mass composed of two parts of unslaked lime and one part of charcoal is cast upon the exposed surface of an impure privy or cesspool; upon this is poured after a few hours a solution of sulphate of iron, which has been prepared by adding the salt to boiling water in the proportion of five pounds to the gallon. A sufficient amount of this solution to saturate the mass should be used, and its application should be made daily.

In the consideration of agents which act as disinfectants to human excrement the value of fresh earth must not be overlooked. Its value during the late war in privy sinks, which were daily used by large numbers of men, was fully demonstrated. The practice, which is so universal through the Southwest, of defecating upon the ground and of leaving the excrement uncovered, should be rigidly discountenanced, and the use of sinks which may be disinfected should be insisted upon. The modern earth closet, which is simple in its construction and so cheap as to be within the reach of all, should be universally provided for the use of females. Goodell\* has shown how many and how serious are the disorders to which the female is liable arising from the miserably faulty closet conveniences which, especially in the country, are provided for their use.

During the prevalence of cholera it is most prudent for those persons living in the immediate vicinity of infected localities to adopt some measures by which the disinfection of the atmosphere may be accomplished. It has been shown by various experiments that during the prevalence of cholera there is an absence of ozone in the air. Ozone is a peculiar element, which is supposed to be oxygen acted upon by electricity. It is characterized when in a concentrated form by a peculiar, pungent odor, "and by its intensely oxidizing and bleaching power, so that substances on which common

\* Philadelphia Medical Times, August, 1873.



oxygen produces no effect are rapidly oxidized on contact with air which contains only a small portion of this odorous principle." \*

To detect the presence or absence of ozone in the atmosphere, Schönbein, the discoverer of this element, prepared slips of paper, which, having been soaked in distilled water, were placed in a solution of iodide of potassium and starch, in which they were left for five or six hours. They were then dried in a cool, dark place, in the horizontal position, so that the iodide solution might be equally diffused.

The experiment is performed by hanging these papers in a box from which the bottom has been removed. They should not touch or rub against each other, and on being exposed for observation should be moistened with distilled water. If ozone is present in the atmosphere, the slips are rendered blue; if the ozone is deficient, no change of color is produced.

Various other processes have been described by which these papers may be prepared and the presence of ozone determined. Conspicuous among them are the methods of Moffat, Lowe, and Beard.

Although by some authorities the peculiar properties ascribed to ozone are doubted, still the majority of observers describe it as the vital element of the air; "*that from its presence oxygen is life-supporting, and that in the absence of ozone offensive products in the air are increased, and all diseases which show a putrefactive tendency are influenced injuriously.*" †

Several methods for the artificial production of ozone are described: the slow oxidation of phosphorus, the slow combustion of sulphuric ether. The method of Boeltzer, of adding one part of sulphuric acid to two parts of permanganate of potash, is attainable by all. This mixture will continue to give off ozone for several months.

\* Brande and Taylor's Chemistry, p. 110.

† Peters, op. cit., p. 103; Parkes, op. cit., 1. 83-85.

For the purification or disinfection of the air many other expedients are suggested as of practical value. *Charcoal*, from its rapid absorption and subsequent oxidation of organic emanations. *Chloride of lime*, exposed in a shallow vessel and moistened with water, gives off chlorine, which is supposed to destroy organic matter. *Bromine*—This substance, diluted and exposed in saucers, is a popular aerial disinfectant. *Nitrous acid*—the gas may be evolved by placing a small portion of copper in dilute nitric acid—is a most powerful disinfectant. *Sulphurous acid*, most easily evolved by burning sulphur, is also supposed to act powerfully on organic matter.

It is prudent that during a cholera epidemic one or other of these disinfectants should be exposed in all rooms of houses, especially those used as sleeping-apartments; but if bromine, nitrous, or sulphurous acid be employed, great care should be used that the gas is disengaged slowly.

The theory that flies may become the carriers of cholera poison has been advanced; and as the idea carries with it an air of plausibility, effort should be made to counteract any injurious influence which they may exert. The most scrupulous cleanliness, not only of cooking-utensils and table furniture, but of the rooms in which food is stored or prepared, should be observed. Gauze covers for dishes should be used, and every appliance which may prevent their entrance into houses should be adopted.

The occurrence of a case of cholera in any community should lead to a general and complete disinfection of all points at which the individual may have been during the few days previous to his attack. With the first symptoms of the disease the house in which the patient lies should be put in order. The various vessels and appliances for the sick should be without excitement placed ready at hand. The vessels from which drink and medicine are to be administered should be placed in the room, and not mixed indiscriminately with those in use by the healthy members of the

family. A deep but narrow pit should be dug in the yard adjoining the house, in such position that no possible drainage can be established to the water-supply, and the bottom of this pit should be covered with the crystals of the sulphate of iron. A large supply of a saturated solution of copperas should be prepared, and after each vomit or dejection of the patient a quantity of this solution should be added, and the whole intimately mixed. The vessel containing the mixture should be at once carried from the house, its contents emptied into the pit; the vessel should be carefully washed, and the water which has been used for that purpose should be treated as the dejection has been. The mass at the bottom of the pit should now be covered to the depth of two or three inches with fresh earth. This maneuver must be repeated after each use of the vessel.

A tub of water, which has been strongly impregnated with carbolic acid, the addition of which must be made with boiling water, should be in a convenient position, into which all cloths or articles of clothing should be cast as soon as removed from the patient. Should necessity require bathing of any portion of the patient's person, water containing a large per cent of carbolic acid or a solution of the permanganate of potash should be employed, and in a similar fluid the attendants should frequently rinse their hands. When the dejections are passed involuntarily, and the clothing beneath the patient becomes saturated, carbolic acid or the permanganate should be added.

Should death occur, all clothing which has been on or around the body should be at once removed and instantly thrown into the tub of carbolized water. The body should be washed in one or other of the disinfecting fluids, and all water which has been used on the person or on the clothing must be treated as the dejections have been. Should the mattress be found soiled with the discharges, it should be burned at once. Indeed it would always be more prudent

to destroy by fire all fabrics which have been soiled by these fatal dejections than to risk the development of a single new case. The body having been placed in the casket, crystals of sulphate of iron or of permanganate of potash should be placed around it, so as to act upon any product of decomposition which may occur prior to burial, which in no case should be delayed.

It is prudent and well for the healthy occupants of a house in which cholera has become developed to at once subject themselves to some prophylactic treatment. Experience seems to indicate that an acid mixture containing quinine and iron is most efficient. Should a second case occur, at its termination the house should be abandoned, at least until a most careful system of disinfection shall have been instituted.

IV. INDIVIDUAL HABITS. — Niemeyer,\* writing in 1870, says:

“Certain influences appear to increase the predisposition to the severer forms of the disease, or to diminish the resisting power of the organism to the action of the poison. Chief among these are errors of diet, emetics, and laxatives, catching cold, and other debilitating influences. It is true, foolish people seek to excuse their excesses at the time of cholera epidemics by saying that the mode of living can have no effect in inducing cholera, because persons who lead the most proper lives are attacked by and die of the severest forms of the disease. Whoever is exposed to a poison whose action kills many persons, while others recover from it, is foolish to subject himself to injurious influences which lessen his chances of recovery, even if the avoidance of these injurious influences gives no guaranty of a favorable termination.”

We have quoted the remarks of Niemeyer in full, so applicable are they to a class in every community who find in times of public danger only fresh and additional excuses for self-indulgence.

It is related by a prominent physician of Paducah, Ky., that during the epidemic of 1873, “after the sale of vegetables had been prohibited within the city limits, that the

\*Op. cit., p. 647.



mortality among the poor whites and negroes diminished; but that many of the German population, regardless of the prohibition, would go out of the city and obtain vegetables. It came to be a recognized fact that Monday was the largest *burping*-day, from the fact that individuals of this class would drink excessively and eat freely during Sunday, and a large number were invariably attacked with cholera on Sunday night and Monday morning."

On the development of an epidemic of cholera it is well for all persons in whose power it may be to at once leave the infected locality. Niemeyer's rules were:

- (1) *To start soon enough.*
- (2) *To go as far as possible.*
- (3) *Not to return until the last trace of the disease had disappeared.\**

Admirable rules, if adopted and carried out to the letter. But one who starts too late may carry the disease in his person; one who travels too short a distance may be overtaken by the disease; while those who return to their homes with the same haste that attended their departure not infrequently fall victims to the disease.

Flint recommends that the removal of persons in districts where, *owing to the activity of auxiliary causes, the disease is especially rife, should be enforced, as a sanitary measure, by municipal authority.†*

Those individuals who remain in an infected locality during an epidemic of cholera, from necessity or from philanthropic motives, will do well to observe rigidly fixed rules as to their individual habits, which may properly be considered under several heads. Of personal cleanliness sufficient has already been noted; we therefore pass to other considerations.

1. *Dress.*—The surface of the body should at all times, both of the day and of the night, be fully and warmly pro-

\* Niemeyer, *op. cit.*, p. 662.

† Principles and Practice of Medicine, p. 468.

tected. Under-garments which have become saturated with perspiration should be removed, the surface of the body briskly rubbed, and dry articles substituted. Whatever may suddenly check perspiration or induce a chilliness is considered dangerous and should be avoided. A broad flannel bandage worn over the abdomen and around the person, even in the oppressive weather of summer, will impart a sense of comfort and a decided relief to the abdominal malaise so universally experienced during a cholera season.

2. *Diet.*—While it is advisable for all persons to be careful in their diet, and rigidly to avoid all articles of food that are known to be indigestible, it is still as necessary not to produce too sudden and radical a change in the diet. In other words, excesses of all kinds should be avoided; the digestive apparatus should be encouraged to the performance of its duty by the presence of good, well-prepared, wholesome food. Beef, mutton, poultry; rice, hominy, farina; wheat, corn, rye; coffee, tea, chocolate; and the various condiments, as salt, pepper, mustard, and other spices, may be freely used. Nor can we see any reason why such articles as butter, milk, eggs, etc., which a distinguished physician prohibits under the generalization of animal products, should be prohibited. Wine, brandy, and malt liquors may not only be allowed, but when used in moderation are extremely useful in averting those debilitating influences which so often prevent the system from repelling the disease; but their use should be interdicted positively whenever undue stimulation results. Experience has shown that a debauch predisposes to cholera when the disease is epidemic.

The free use of salt with food during a cholera epidemic is strongly recommended by several writers, who urge that the debilitated condition of the stomach and bowels, which is known to predispose to cholera, is removed by its tonic influence. In this way it has undoubtedly some prophylactic power. Its value as a disinfectant is recognized.

The condition of the drinking-water should always be an object of solicitude, and it is well to cultivate self-control, and to refrain from drinking water except from the supply which is habitually used; that is, a person whose home is in an infected locality should be careful to supply his family with pure drinking-water, and should impress upon one and all the absolute necessity of drinking none other.

In relation to the vexed question of the use of fresh vegetables and fruits, upon which so much has been written, it is safe to assert that such ripe and well-cooked vegetables as an individual habitually uses with impunity may be eaten during a cholera epidemic; but when it is known that certain articles have invariably produced indigestion when eaten prudence demands that they should be rigidly avoided.

The necessity of restrictions among the lower classes of society arises from the fact that persons of this sort imprudently indulge in the use of unripe and badly-cooked vegetables, or those in which the process of vegetable decomposition already has commenced. But it is not to be imagined that such fruit will *per se* produce cholera. It may induce an attack of sporadic cholera or cholera morbus, and it does predispose to the rapid development of the disease after the specific poison has entered the alimentary canal.

It is well to close this paper with a remark borrowed in part from Dr. Murray. Concealing the truth does no good; but it creates confidence when a true knowledge of the mode by which cholera is communicated, and the absolute power which disinfectants exercise in arresting the spread of the disease, is made public.

LEBANON, KY.

1875  
1876  
1877  
1878  
1879  
1880  
1881  
1882  
1883  
1884  
1885  
1886  
1887  
1888  
1889  
1890  
1891  
1892  
1893  
1894  
1895  
1896  
1897  
1898  
1899  
1900







